(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2004 (23.12.2004)

PCT

(10) International Publication Number
WO 2004/111324 A1

(51) International Patent Classification[7]: D06F 33/02, 37/20, 37/30

(21) International Application Number: PCT/EP2004/006279

(22) International Filing Date: 10 June 2004 (10.06.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03425379.9 11 June 2003 (11.06.2003) EP

(71) Applicant *(for all designated States except US)*: **ASKOLL HOLDING S.R.L.** [IT/IT]; Via Industria, 30, I-36031 Povolaro di Dueville (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **MARIONI, Elio** [IT/IT]; Via Molino, 6, I-36031 Dueville (IT).

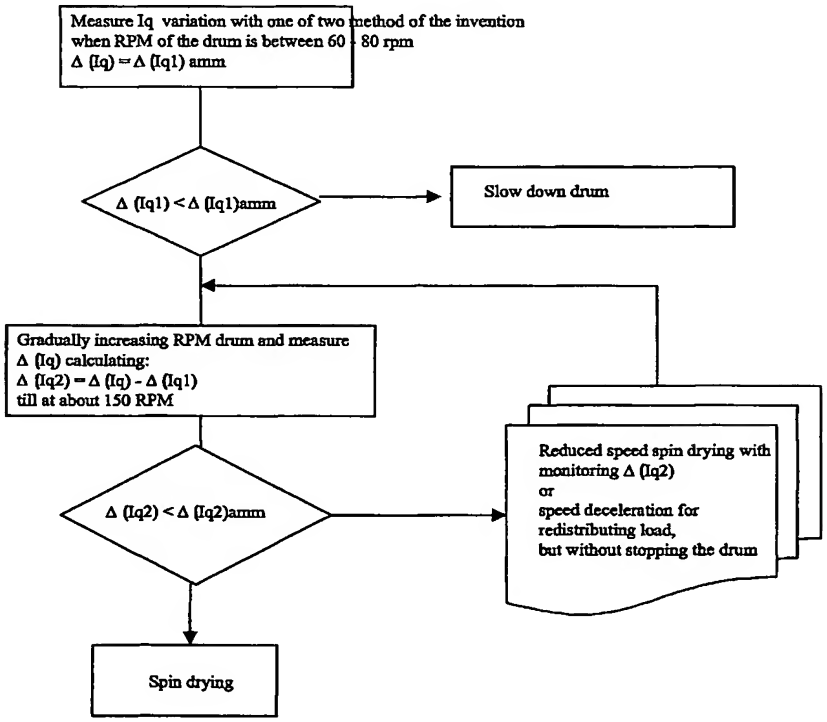
(74) Agents: **BOTTI, Mario** et al.; Botti & Ferrari S.r.l., Via Locatelli, 5, I-20124 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

[Continued on next page]

(54) Title: METHOD FOR DETECTING UNBALANCED CONDITIONS OF A ROTATING LOAD DRIVEN BY A SYNCHRONOUS MOTOR AND FOR CONTROLLING SAID MOTOR



(57) Abstract: The invention relates to a method for detecting unbalanced conditions of a rotating load driven by a synchronous electric motor (3) in washing machines (1) and similar rotably drum (2) household appliances and wherein at least a transient step is provided with variation of the angular speed (w) of the rotably drum (2). The method provides the following steps: constantly monitoring the instantaneous current (Iq) absorbed by the motor calculating in real time the unbalanced mass (m) on the basis of the variation (Δ) of the current (Iq) and starting from a predetermined reference and by applying a calculation formula representative of the kind of load imbalance. Moreover, the imbalance signal may be computed as a difference between the last sampled value of the current signal (Iq), in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is positive, and the last sampled value of said current signal (Iq) in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is negative. current driving the motor (3) according to said unbalanced mass (m).

WO 2004/111324 A1

SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2004 (23.12.2004)

PCT

(10) International Publication Number
WO 2004/111324 A1

(51) International Patent Classification[7]: D06F 33/02, 37/20, 37/30

(21) International Application Number: PCT/EP2004/006279

(22) International Filing Date: 10 June 2004 (10.06.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03425379.9 11 June 2003 (11.06.2003) EP

(71) Applicant *(for all designated States except US)*: **ASKOLL HOLDING S.R.L.** [IT/IT]; Via Industria, 30, I-36031 Povolaro di Dueville (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **MARIONI, Elio** [IT/IT]; Via Molino, 6, I-36031 Dueville (IT).

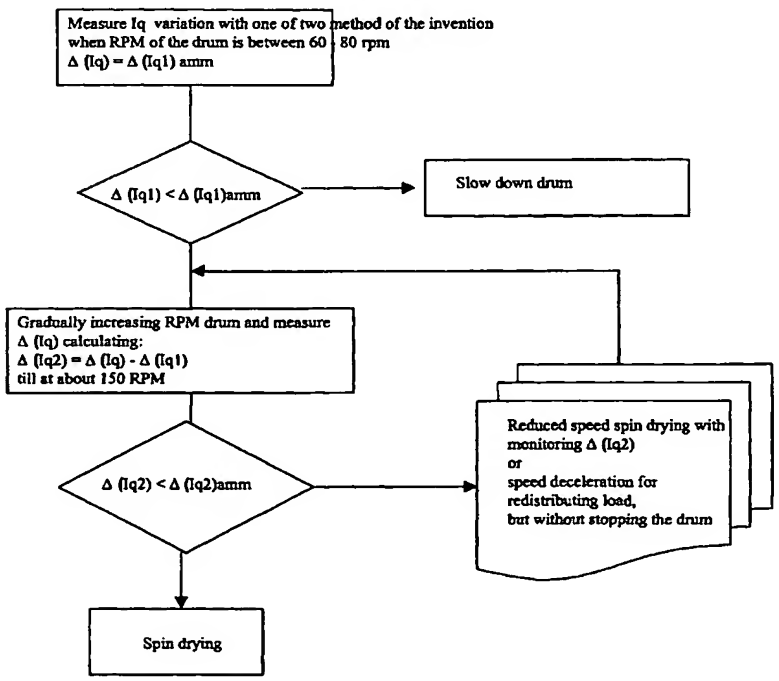
(74) Agents: **BOTTI, Mario** et al.; Botti & Ferrari S.r.l., Via Locatelli, 5, I-20124 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

[Continued on next page]

(54) Title: METHOD FOR DETECTING UNBALANCED CONDITIONS OF A ROTATING LOAD DRIVEN BY A SYNCHRONOUS MOTOR AND FOR CONTROLLING SAID MOTOR



(57) Abstract: The invention relates to a method for detecting unbalanced conditions of a rotating load driven by a synchronous electric motor (3) in washing machines (1) and similar rotably drum (2) household appliances and wherein at least a transient step is provided with variation of the angular speed (w) of the rotably drum (2). The method provides the following steps: constantly monitoring the instantaneous current (Iq) absorbed by the motor calculating in real time the unbalanced mass (m) on the basis of the variation (Δ) of the current (Iq) and starting from a predetermined reference and by applying a calculation formula representative of the kind of load imbalance. Moreover, the imbalance signal may be computed as a difference between the last sampled value of the current signal (Iq), in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is positive, and the last sampled value of said current signal (Iq) in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is negative. current driving the motor (3) according to said unbalanced mass (m).

WO 2004/111324 A1

SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *with amended claims*

Date of publication of the amended claims: 10 February 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.